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# USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT



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USSR REPORT  
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## INDUSTRY PLANNING AND ECONOMICS

### TOCHLITMASH DIRECTOR INTERVIEWED ON MACHINE BUILDING

Kishinev KOMMUNIST MOLDAVII in Russian No 11, Nov 86 pp 43-50

[Interview with General Director of the MSSR's Tochlitmash (Moldavian Precision Casting Machinery) Production Association imeni S. M. Kirov, Deputy of the USSR Supreme Soviet and Hero of Socialist Labor A. I. Bolshakov by L. Dmitriyev: "Machine Building--the Main Direction of Scientific and Technical Progress"]

[Text] [Answer] Of those sectors which determine technical progress in the national economy, the machine tool-manufacturing industry occupies a special place. The operating efficiency of industry, the quality of our manufactured output and its technical and economic parameters depend in large part on this sector. Moreover, the need to introduce improved, highly productive equipment and progressive production methods is dictated by the interests of making the best possible use of our manpower resources.

As is well known, our enterprise is the country's sole manufacturer of automated production lines for permanent-mould and centrifugal casting using investment patterns and shell moulds. It is precisely our products which have been associated in large part with more rational metal consumption. Actually, if the foundries produce castings having little similarity to the final product in their shape and dimensions, then the next labor-intensive operation--mechanical finishing--would come to a standstill. You can imagine, considering the present scope of machine building, the quantity of leftover metal we would have on our hands.

It is now possible to avoid wasting all this metal thanks to new production resolutions: the production of castings which require almost no additional labor outlays. For every 1,000 t of these castings, 200 t of metal are saved, and 15 machine tools and up to 30 highly-skilled workers are freed for other work. The nature of casting production has undergone a radical change: working conditions and the caliber of the labor have been improved.

Every year our enterprise collective develops dozens of new and more productive casting machines and automatic transfer lines. ZIL [Moscow Motor Vehicle Works imeni Likhachev], VAZ [Volga Motor Vehicle Works], the Chelyabinsk, Minsk and Kharkov tractor plants, Rostselmash [Rostov

Agricultural Machine-Building Plant] and the Altay Motor Vehicle Plant have been equipped with our automatic transfer lines.

We consider the version used in the Altay plant the most successful. The machines installed here helped to set up the country's first completely mechanized shop. Their lay-out of high-capacity foundry equipment completely eliminates the need for manual labor, and all the intermediate operations have been automated as well. A worker who previously had to pour the metal with a ladle now controls two or three casting centers. The shop has over 100 of these centers. Each of them represents a final production cycle.

The Altay Motor Vehicle Plant has become the standard when similar shops are set up in various industrial sectors. It stands as the highest measure of the achievements in the foundry industry. But there is a lowest measure as well. Here we are referring to shops with imperfect production methods, obsolete equipment and a low mechanization level. These are the very shops which are the prime suppliers of defective output. And unfortunately, there is quite a bit of this in the foundry sector overall.

I want to emphasize that our industry presently has at its disposal a great deal of highly efficient equipment which is still being used inefficiently. On the other hand, we often find obsolete or unpromising machines being put into production. Apparently the time has come for a critical assessment of what we are manufacturing, how we are going about it, the assets we are using to do so, and what these outlays are costing us.

[Question] As is well-known, Tochlitmash is highly influential. People inside and outside our country are acquainted with your products, which are exported into a number of foreign countries, and which hold their own in competition with well-known firms world-wide. What is the most decisive factor in the work of your collective?

[Answer] I'll give you those factors in the most general terms: an orderly production system, highly organized labor, creative surroundings, and concern and attention given to every detail. The total complexity of our present-day assignments conspicuously exemplifies our association. We have already been operating for a number of years while radically renovating our works, and are in the process of introducing the most up-to-date production methods. The renovation of our shops has more than doubled our production of output having the State Quality Mark.

We don't quibble or pretend to be poor when making up our production plans, and we take on the most strenuous assignments, those requiring everything in our power to carry out. During the 11th Five-Year Plan period, we were able to increase our production of output 1.5-fold over the preceding five-year plan period. And for such a vital indicator as the manufacture of automatic transfer lines and automatic machine complexes--by almost 2-fold. We exceeded the five-year plan assignment for consumer goods manufacture by R12 million.

Of course it's not easy to bear such a work-load. But we have taken it on voluntarily. We did so because we understood the value of our equipment to the national economy, and how much our collective values the esteem placed in

the enterprise and the prestige of our trademark. The stress of our work forces us to think sharper and faster and, as they say, to give ourselves the right slant towards improving and devising innovations.

In order to ensure our planned fast pace for the development of production, we have set up 15 mechanized parts-machining, and assembly and welding sections; we have set up a shop equipped with programmed-control machine tools; we have reduced the time used in planning and introducing new equipment, and most of our brigades have been changed over to working on a unified contract. We have implemented more than 200 measures aimed at improving the quality of our output. The result of this has been that during the past five-year plan period our association managed to manufacture R129 million of output, and this was only that which was over and above our assignment.

Our progress forward starts with our present economic potential. By and large, success in an affair depends on how competently and thriftily we use that potential and the degree to which we allow our workers, engineers and shop managers to make the best choices when solving production-related problems.

During the last five-year plan period we were able, by using our accumulated experience and our organizational and technical innovations, to initiate series production of robot-manipulators. Automatic manipulators joined to a casting machine comprise a unified complex which is controlled by an operator. Such complexes are already in operation in the Chelyabinsk Tractor Plant's shops and in a number of electrical engineering industry enterprises. Casting machines have been set up to operate under electronic control systems.

For the first time domestically, completely automated production of precision steel and non-ferrous castings has been set up at the Kama Motor Vehicle Works. Tiraspol Litmash delivered three automated transfer line set-ups fed by manipulators for this plant. According to data from the Moscow NIIavtoprom [Scientific Research Institute of the Motor Vehicle Industry], thanks to the production of castings needing no further machining, this plant has been able to free 450 metal-cutting machine tools and 815 workers. And yearly savings in metal amount to 3,000-3,500 t.

Taking into account the inquiries from domestic industry and making use of the latest achievements of science and technology, we have succeeded in solving an extraordinarily critical problem by finding a way to replace rolled metal stock and forgings under pressure. This new method has reduced high-alloy steel consumption by one-sixth and has increased labor productivity 5-fold.

[Question] But such is the logic of technical progress: the more that is done today, the more needs to be done tomorrow. The completion of one set of jobs always becomes the start of other, more complicated jobs. In this regard, we would like to know what goals the collective has set for itself for the 12th Five-Year Plan period.

[Answer] As is well known, the machine-building industry plans to reduce the time spent on developing and initiating production of new equipment by one-third to one-fourth, and hopes all its newly developed models will surpass



similar models now in production by no less than 1.5- to 2-fold in productivity and reliability. The Kirov plant workers' primary efforts have been concentrated in this very direction. We are gradually changing over from producing individual machines to the setting up of production lines and highly-mechanized complexes.

Special mention should be made of the programmable master-controllers developed by our designers and technicians, which operate through microprocessors. Among their virtues, they are highly reliable and compact. But perhaps their most important feature is their programs, which can be changed (i.e., reoriented to the production of totally new products) in only 15 minutes. This allows the use of "electronic foundrymen" in controlling a variety of automated transfer lines as well as--and this is particularly important--in flexible automated productions, the predecessors of the automated plants of the 21st century.

The development of reliable, economical and durable machines ought to evolve along a single broad front. Here, progress cannot be accelerated without a corresponding speed-up in the rates at which electronics and electrical technology develop, and if a highly-efficiently designed array of machines and devices is not manufactured in sufficient quantities.

Fairly often our designers and developers have to devise new types of sensors which meet the particular needs of casting production. Attempts to have them manufactured by those enterprises whose specialties conform to the proposed assignments have not met with success. Do we then stop at the halfway mark? No; we decided to make them ourselves, understanding that this involves a lot of worries. We have already developed the instruments and set up their manufacture in place. In a word, we have managed to maximally automate the development of casting machines and to introduce robots and computers extensively into the production process.

We are bringing more robots into our own production. We have set up a 16-robot section in one of our machine shops, and another 10 are being set up nearby. We plan to have the sector's first robotized shop before the end of this year.

The laying out of metal--one of the most time-consuming and labor-intensive operations--has also been completely automated. The lay-out machines, which use gas and plasma to perform their functions, operate on a program and can be easily readjusted to the most diverse tasks during a single work-shift.

[Question] The decisions of the 27th CPSU Congress call for the machine-building complex, and machine-tool building first of all, to undergo a radical renovation and rapid development. They specifically call for the extensive introduction of rotary production conveyer complexes into production situations. As is commonly known, your association has begun developing these complexes, and has even manufactured the first experimental models. What are your prospects here?

[Answer] Rotary and rotary-conveyer transfer lines have been referred to as the foundation of revolutionary production methods for a long time, and

they fully deserve the title. Picture it for yourself: a piece of metal or some other material is placed into the machine, and out comes a completely finished part. What production facility hasn't dreamed of this kind of this kind of technology? It both drastically increases labor productivity and frees people from manual operations. And this can be done using rotary equipment. It was no accident that the Politburo of the CPSU Central Committee discussed the problem of their use in its meeting last September.

Our collective has initiated production of rotary-conveyer transfer lines for foundries. One of these lines was recently put into operation at the Machine Building Plant imeni Lenin in the Siberian city of Kurgan. The unit, which is designed for casting with disposable patterns, has already reached its design capacity of 150 blocks per hour. This means that the automated complex has turned out to be 6-fold more productive than its predecessor, which we delivered to the same plant several years ago.

And here's a report from Kiev about another of our innovations. The Rotolin (rotary line) pilot demonstration project installed at the plant imeni Lipse has been instrumental in sharply increasing labor productivity, in reducing the weight of every blank by up to two kg and in improving casting quality. Moreover, thanks to this, the enterprise has been able to free no less than 100 workers involved in auxiliary operations.

We became enthused about the idea of devising a rotory founder long ago. True, we encountered quite a few problems, and there were in fact no similar units in world practice. In particular it was thought that, when using molten metal it would be impossible to attain precision, and that the moulds could not be continuously moved. However, the creative brigade, whose members included designers, technicians and workers, succeeded in devising an experimental model of a rotary founder. Industrial tests made on two different units in Kiev and Kurgan have confirmed that we have achieved our goal.

The creation of foundry equipment which operates independent of production and transfer operations will make it possible in upcoming years to equip many foundry works with rotary-conveyer transfer lines, to reduce the vast array of equipment in those very same works and to markedly cut back on the number of foundry workers.

One of the primary objectives the Tochlitmash collective has set for itself is setting up the mass manufacture of new generation equipment capable of ensuring repeated increases in labor productivity and of blazing the trail towards automation of all stages of the production process.

Our goal has the fervent support of the USSR State Committee for Science and Technology, whose board has adopted a resolution to include the Tiraspol innovation in its goal-oriented Rotor Program and to recommend that it be widely introduced in industry. It should be said that the sectorial scientific and technical institutions are not standing on the sidelines in this matter. Thus, for example, the UkSSR's Scientific Research Institute on Casting Problems has already participated most actively in the initial developments of this rotary equipment. And right now the institute's associates are working alongside our specialists on improving these units. Our



partners in Kiev participate in all our developments and are, we feel, ready to look for solutions to any complicated problem.

Strong ties have been established between the association's collective and the USSR Academy of Sciences Institute of Machine Science, the Ministry of the Automotive Industry's Scientific Research Institute in Moscow and dozens of other scientific and design institutions. Who does not know that it is impossible to develop new up-to-date machines without the participation of science and enterprises from other sectors? And without the contribution of each of them into the "common pot", a new machine might not make its appearance for a long time indeed.

Not all the traditional ways and means of organizing production are suitable today, particularly when developing and manufacturing new equipment. And the essence of the problem is not that instead of this machine, we need to develop that one. We should change our complex of opinions about the whole matter and form a radically new industry capable of developing any new design within 6-8 months. But for now, these remain our fond desires. In order to initiate production of a new model today we have to have at least 100 signed authorizations outside the plant, which takes 2-3 years. Our best designers spend a tremendous amount of time and effort, not working at the drawing board, but making the rounds of the departments in order to "protect" their new machines.

Several years ago, in compliance with a resolution of the Moldavian Communist Party Central Committee and the government of the republic, our collective was charged with manufacturing a complex of machines for the former Minplodoovoshchkhov [Ministry of the Fruit and Vegetable Industry] and the Tabakprom [Tobacco Industry] Association. We took care of it. A great many Litmash workers and specialists were awarded the MSSR State Prize for this work. The machines manufactured here work reliably and efficiently, but their specifications are, alas, still being correlated even today. And there's a great deal of conservatism within technology. Even a gifted engineer has to spend a great deal of time not in purely creative work, but in drawing up technical documents dealing with, for example, a description of the machine's operation.

In this connection, it is apparently thought that a worker knows nothing in this area, and thus is given the most detailed instructions, 50-60 pages at a time. They tell him exactly how he is supposed to work, and depict all the intermediate operations. Last year I visited a number of enterprises in Italy and the FRG where I saw that this sort of technical document took up only a single page. It only showed the worker what he had to do, and he is supposed to know this himself. In fact, he is only charged with doing work covered by his skill level.

The decisions of the CPSU Central Committee are completely reasonable when they point out the need to expand the rights of enterprise and association managers while at the same time increasing their personal responsibility for the technical level of their output. At present, unfortunately, there is not a single director who has the liberty to maneuver or to manifest bold initiative. Similarly, the formal observation of a paragraph in some

instruction or other is considered more important than taking care of the business at hand. Isn't this why the stream of paperwork has not slackened in the least, and why many experienced engineers and designers have been forced to fritter away their talents on petty and long, drawn-out bureaucratic proceedings?

I feel I should mention our innovation of the extensive use of the USPO [Universal Readjustable Assembly Device]. It is made up of sets of basic elements from which one can choose various attachments for performing a number of operations on any machine tool. The use of the USPO has markedly improved the organization of production, has reduced the number of planning jobs, has accelerated the preparation of production and as a result has cut down the time needed to develop new products. We use universal assembly devices widely in machining, welding, assembly and checking.

Every year our USPO Section puts together about 20,000 different sets of attachments. At the same time, no more than one working shift goes by from the time the orders for it to be set up are authorized to the time they are issued. As a result, the use of the standard attachment system has reduced the demand for the former system in production by almost one-quarter and has sharply increased labor productivity, and has improved the quality and enhanced the reliability of our machines.

Considering that the foundry industry occupies a significant place among all the industrial sectors and is one of the most labor-intensive as well, the association collective decided to accelerate the manufacture of those machines which are used in those major highly-mechanized foundries which use flexible readjustable manufacturing systems at all stages of the production process. These machines greatly expand the use of low-waste production equipment and save substantial quantities of metal, power and manpower resources. This will be our major labor contribution during the 12th Five-Year Plan period.

[Question] The fate of scientific and technical progress depends in large part on the human factor. What is being done at Tochlitmash in this regard?

[Answer] Recently we have done a great deal to motivate each worker to make the most of every opportunity to increase production. At the S. M. Kirov plant alone, 278 brigades have changed over to the unified contract, and many of them work on a total cost-accounting basis. The management and party committee of the association give a lot of attention to the selection of brigade supervisors and set up party groups within the brigades. And party organizers work where the above is not possible.

In the life of the labor collectives, economic, technical and moral questions are very closely related. This forces us to think of ways to structure our work so that the level of the production management corresponds to the spirit of the times. The search for reserves takes us in many different directions. The main one is in improving the established system of measures for accelerating scientific and technical progress. The most critical link is that of thoroughly planning the technical reequipping of production. We are making certain that all measures related to the renovation and modernization of our equipment and to the mechanization and automation of production are

coordinated with the economic indicators, capital investments, and outlays of manpower and material resources.

The yearly updating of approximately a fifth of our output of products by using improved designs is one of the main directions in developing our production. The second, though no less important direction, is the improvement of our production methods. During the 11th Five-Year Plan period, this practice made it possible for our collective, in addition to increasing the manufacture of machines, to make them highly competitive and to markedly increase export deliveries.

Economic restructuring is organically related to restructuring people's consciousness, and is defined by the changing of settled notions and concepts. It is imperative that this be taken into consideration. It is for this reason that we are now striving to ensure the utmost openness when working out any decision on any level. We need for people to know our tasks as well as our difficulties. The better a person knows what he is doing and why he is doing it, the better his work will go.

Take, for example, the inventors' and innovators' movement. For the last several years skilled craftsmen from our plant have obtained 76 inventor's certificates on the inventor's level. And several of them have been patented in a number of countries. In the last two years, some 800 efficiency recommendations have been submitted. The best developments have been distinguished by 13 gold and 299 silver and bronze medals at the Exhibition of USSR National Economic Achievements. Thus, the mark made by Yu. Karabinenko is a good example to his comrades. He has about 100 inventions and refinements to his credit, and his achievements have been awarded the USSR State Prize.

A machine builder's work is collective by its very nature. The Kirov workers' spirit of collectivism, their genuine comradeship and tactful and caring attitude towards people is particularly strong. I think that "indicators" like these play a major role in the stable work of this enterprise.

At first glance, improving the effectiveness of public production seems a purely technical task. But we are also interested in its ethical aspects: how do people relate to it, and are they prepared to solve this complex problem? Let's take a simple example. The collective is discussing its obligations. One member has his say; and then another. A third says nothing. Pay no attention to him, they say; let him remain silent. But if he were to be asked, "What exactly do you think?", then more often than not it would come out that he has something to say, or a suggestion.

More than anything else, a plant is people; not machine tools. And if a worker sees and senses that someone is concerned for him, then he will be sure to respond to it, and fulfill the tasks assigned to him in the plan. Science calls this "social effectiveness". In other words, the greater the degree to which human needs are met, the greater an individual's creative yield.



People's labor-related activity is not isolated from their personal life and all its manifestations. Instead, it is in an intimate interrelation with it. The importance of this trend in labor was emphasized in the April 1985 CPSU Central Committee Plenum where it was stated that "We must be extremely attentive with regard to everything that concerns man, his work, his material welfare and his leisure."

Man has been and remains the fundamental starting point for all those measures and plan sections related to the collective's economic and social development which have guided our work for over 10 years. Today there are a number of economic problems which cannot be solved by purely technical or administrative methods. The educational factor is becoming increasingly important relative to the level of people's consciousness and to such moral categories as honesty, conscience and the higher public interests. Take for example the socialist competition. The Kirov plant workers have long had a profound understanding of its role as a powerful motive force, not only with regard to economic and social progress, but in spiritual and moral education as well. Even during the prewar years, our workers were initiators of the Stakhanovite Movement in both the city and the republic. It is thanks to the unceasing concern of our brilliant advanced workers that the glorious traditions of innovation are being multiplied, and that numerous new changes are appearing these days, of which our entire collective is rightfully proud. We have managed to "compact" the last five-year plan program for production of automatic transfer lines and industrial robots by more than a year and a half. The collective has begun the 12th Five-Year Plan period just as successfully. The year's deliveries of machines and equipment to the shock projects of Siberia and the Far East have already been made, and the collective has already coped with the annual program for consumer goods production. And there's still another indicator which could hardly fail to make us happy: every month, the enterprise makes its deliveries in accordance with its industrial contracts.

We see reserves in the development of new production methods, in the further strengthening of our contacts with science, in improving the brigade contract and introducing full plant cost accounting, in the engineering support of our stringent socialist obligations and in the utilization of all the opportunities which have become available by virtue of our economic experiment. But without doubt, the most important of our reserves is the creative exploration of our collective, which numbers in the many thousands, aimed at fulfilling the 12th Five-Year Plan ahead of schedule.

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## INDUSTRY PLANNING AND ECONOMICS

### ECONOMIC ASPECTS OF TECHNICAL PROGRESS, RETOOLING NOTED

Moscow PLANOVVOYE KHOZYAYSTVO in Russian No 11, Nov 86 pp 59-66

[Article by V. Lebedev, candidate of economic sciences: "The Economic Law of Predominant Growth of the Production of Means of Production"]

[Text] The law of the predominant growth of the production of means of production occupies an important place in the theory of socialist expanded reproduction and in the practice of building communism.<sup>1</sup> Its realization in the economic policy of the CPSU has guaranteed successful performance of the most important socioeconomic and political tasks in the history of the Soviet state: industrialization of the economy, building up the defensive potential and the victory over fascist Germany, successful economic recovery, and the present-day material and technical base of socialist production.

Now the task has been set of accelerating the country's socioeconomic development. Its successful performance also presupposes vigorous use of the law of the predominant growth of production of means of production. But in the economics literature an unambiguous position concerning it has not been worked out so far. The discussion is continuing (dying out for awhile, then flaring up with new force) concerning the relationship between the growth rates of Departments I and II of social production in the context of the predominantly intensive type of socialist reproduction.

Theoretical Aspect. The economic law of the predominant growth of production of means of production was first formulated by V.I. Lenin in his article "On the So-Called Question of Markets": "The entire purport and entire significance of this law on the faster growth of means of production consists of nothing more than that the replacement of manual labor by machine labor--in general the progress of technology in machine industry--requires more intense development of production for mining coal and iron, these urgent 'means of production for means of production.'"<sup>2</sup>

It follows from Lenin's definition that branches creating means of production must develop at higher rates, and this in turn is expressed in an enlargement of their share in the social product. Scientific-technical progress is the material basis of this process.



V.I. Lenin drew the conclusion of the predominant growth of production of means of production by starting out with the law of the growth of the organic structure of capital, which is a logical development of the basic principles of K. Marx's theory of reproduction.<sup>3</sup> V.I. Lenin related the historical limits of operation of this law to a certain level of development of the productive forces--to large-scale machine industry. That is why it is not legitimate to attribute the predominant growth of Department I of social production exclusively to the period of initial industrialization.<sup>4</sup>

In speaking about the law of the predominant growth of production of means of production we must bear in mind that Departments I and II of social production are interrelated. V.I. Lenin emphasized that "...it by no means follows" from the predominant growth of Department I "that the manufacture of means of production can develop /altogether independently/ [in italics] of the manufacture of consumer goods and /outside of any relation to it/ [in italics]."<sup>5</sup>

V.I. Lenin saw operation of this economic law as dependent upon technical progress, which in the stage of large-scale machine production takes place through replacement both of manual labor by machine labor and also (indeed to a greater degree) of one machine by another machine (one that is more productive and is less expensive).<sup>6</sup>

The goal of technical progress (and consequently the function of the law of the predominant growth of production of means of production)--is the uninterrupted rise of the productivity of social labor. Technical progress takes material form predominantly in means of production and shapes the relationship between Departments I and II in the social product in a particular way. /It is the law of the predominant growth of production of means of production that expresses the objective cause-and-effect relation between technical progress and the rise of labor productivity on the one hand and the relation between the growth rates of the two departments on the other/ [in boldface].<sup>7</sup> But this relation is not direct; it is mediated through the structure of production.

K. Marx and V.I. Lenin especially emphasize the interrelationship between the organic structure of production and the relationship between Departments I and II. The growth of the organic structure of production figures as the consequence of the acceleration of technical progress, which, in the opinion of V.I. Lenin, is manifested in the fact that "the ratio of variable capital to constant capital (v/c) gradually decreases" and "in the reduction of the role of manual labor."<sup>8</sup> The growth of the organic structure of production brings about an increase in the relative share of Department I in the gross social product and ultimately has the result that the basic mass of embodied and live labor is functioning in branches producing means of production.

It is not legitimate to deny the predominant growth of Department I of social production on the basis that the increase of the organic structure of capital concerns only newly activated capacity or capital advanced, since the organic structure of all functioning capital is in fact increased as a result of this process.

The relationship between the organic structure of production and the dynamic behavior of the growth rates of Departments I and II of social production possesses a general character determined by the general-historical patterns of scientific-technical progress, which are manifested in the reduction of manual labor and in the growth of the mass of the means of production applied. This general connection makes its way under the impact of various factors which only modify it, but do not eliminate it.

There are differing points of view in the economics literature concerning the law of the predominant growth of Department I. Some authors explain it, for example, in terms of a redistribution of means of production and manpower in a branch of Department I or by saying that the production of means of production must in time surpass the production of consumer goods; that is, they derive it from a change in the forms of manifestation of this law under the impact of various factors, not from its general material basis.<sup>9</sup> Others explain it in terms of the social nature of capitalist production relations.<sup>10</sup> Still others say that in the present stage acceleration of development of Department II is the characteristic trend in economic development.<sup>11</sup> A fourth group altogether denies the objective nature of the economic law of the predominant growth of production of means of production.<sup>12</sup>

But in all these cases the authors have not in our view made any further progress in studying the forms of manifestation of the law of the predominant growth of production of means of production, and clarification of the material basis of the law remains outside the limits of theoretical analysis.

So, /how does technical progress, as the general material basis of the law of predominant growth of production of the means of production shape the relation between the two departments of social production? Is this material basis preserved as before in the present stage?/ **[in boldface]** (This question arises because materials-conservation lines of progress have emerged in scientific-technical progress.) These are questions which have the greatest methodological significance.

Technical progress means development of the productive force of labor. As a result live labor is gradually displaced from production and replaced by embodied labor, and the magnitude of the means of production on a per worker basis has a tendency to increase (because one portion of them is the condition and another is the consequence of the rise of labor productivity). K. Marx defined this process as the law of material production in general, "according to which the ever growing mass of the means of production, because of the progress of the productivity of social labor, is capable of setting everything in motion with a smaller and smaller input of human energy...."<sup>13</sup> Consequently, the share of the means of production in the composition of the social product tends to increase, and this takes the form of higher growth rates of Department I.

Under present conditions the impact of scientific-technical progress on the relation between the two departments has been complicated by the emergence of materials-conserving lines of development. But these processes have not altered the materials-intensive nature of scientific-technical progress as a

whole, as is confirmed by the predominant growth of the capital-labor ratio as compared to the growth of labor productivity. Just as earlier, then, technical progress predetermines higher growth rates of Department I of social production.

Scientific-technical progress gives rise to conditions which not only bring about an additional need for means of production, but also guarantee a saving on them, especially because of improvement of technologies and reduction of losses. The questions of conservation of social labor occupy an important place in clarifying the specific features of the operation of the law of predominant growth of production of means of production. In the economics literature attempts have been made to deny the operation of this law on the basis of the saving of embodied labor. But there is no basis for this, since both embodied and live labor are saved, and in fact there is a greater saving of live labor, which also tends to increase the share of Department I in the social product.

**/The Patterns of Development of Departments I and II of Social Production Under Present-Day Conditions/** [in boldface]. In actual reality economic practice deals mostly with the forms in which the economic laws are manifested.<sup>14</sup>

In this connection it has to be taken into account that the laws do not appear in pure form; the forms of their manifestation are modified under the impact of various factors.

The forms of manifestation of the law of predominant growth of production of means of production are the relationship between the growth rates of Departments I and II of social production and the relationship between the relative shares of the two departments in the social product.

The opportunities for statistical analysis of the relationship between Departments I and II are limited. The published data of intersector balances make it possible to study it over the period 1959-1980: the share of means of production in the gross social product increased from 60.3 to 63.5 percent, and the share of consumer goods dropped from 39.7 to 36.5 percent. The growth of the relative share of means of production in the gross social product was accompanied by a convergence of the growth rates of the two departments. For instance, whereas over the period 1959-1966 the relative share of means of production rose 2.9 percentage points, over the period 1966-1972 the increase was 0.2, and over the period 1972-1980 it was only 0.1.

The relationship between production of means of production and production of consumer goods can also be analyzed through the example of gross industrial output. This is legitimate for the following reasons. First, gross industrial output represents about 64 percent of the gross social product and reflects the structural shifts taking place in it. Second, the industrial sector and only the industrial sector is producing the implements of labor and guaranteeing creation of the major portion of the potential for expansion of production. But it has to be taken into account that the relationships between Departments I and II of social production and between Groups "A" and "B" of the industrial sector are proportions at different levels of economic



activity. In many respects these relationships coincide, but they are not absolutely identical. The dynamic behavior of the growth rates of the gross industrial output and industrially produced means of production and consumer goods are given in the table.

<u>Indicator</u>	<u>1961- 1965</u>	<u>1966- 1970</u>	<u>1971- 1975</u>	<u>1976- 1980</u>	<u>1981- 1985</u>	<u>1986- 1990 (plan)</u>
Output of industrial sector-- total	151.00	150.00	143.00	124.00	120.00	125.00
Breakdown:						
Group "A"	158.00	151.00	146.00	126.00	119.60	124.30
Group "B"	136.00	150.00	137.00	121.00	120.80	127.00
Coefficient of predominance	1.51	1.02	1.21	1.22	0.95	0.91

It is evident from the figures in the table that over the course of four 5-year planning periods (from the 7th through the 10th) the growth rates of the production of industrially produced means of production were predominant. Along with this there was a tendency for the growth rates of Groups "A" and "B" of industry to converge, and the coefficient of predominance stabilized in the ninth and tenth 5-year planning periods. Moreover, in certain periods (1968-1970 and 1981-1984) Group "B" developed at higher rates than Group "A" of industry. Faster rates for Group "B" have also been outlined for the 12th Five-Year Plan.

In the present stage the predominant growth of production of means of production is accompanied by a convergence of the growth rates of Departments I and II of social production and by a certain reduction in the share of Department I in the gross social product. A number of authors see this as the pattern of the intensive type of expanded reproduction. For instance, S.P. Per-vushin believes that "the reduction in the share of Department I in the gross social product indicates that intensification of production is becoming stronger."<sup>15</sup> In the opinion of Yu.M. Ivanov, "the intensive growth of production makes it possible to form a system in the proportion of expanded reproduction that is opposite to extensive growth."<sup>16</sup> Intensification of production signifies the application of more efficient means of production. Moreover, it is not legitimate to regard the increase of the means of production solely as an extensive factor, since it promotes a rise of labor productivity on the basis of a rise of the capital-labor ratio.

/So far in the economics literature there has been no convincing explanation of the patterns which bring about convergence of the growth rates of the two departments of social production.

/The convergence of the growth rates of Departments I and II is predetermined by the accumulated productive potential, by the long-term orientation of the party's economic policy toward a further rise in the prosperity of the people, and by the transition to the predominantly intensive type of economic growth, which guarantees optimum and economical use of the means of production./ [in boldface] But we cannot fail to take into account that it (the convergence)

was partly the result of a number of difficulties which began to be manifested in economic development in the late seventies and early eighties, which were manifested in a reduction of the growth rates of social production as a whole and in Department I in particular.

/The principal factor tending to bring about the convergence of growth rates of the two departments is the drop in the rate of accumulation./ [in boldface] For instance, the share of the accumulation fund in the national income used for consumption and accumulation dropped from 28 percent in the 8th Five-Year Plan to 25.9 percent in the 11th. Here the drop in the relative share of the accumulation fund in the national income took place at a time when the rates of economic growth were dropping.

As the transition is made to the predominantly intensive type of expanded reproduction, the drop in the rate of accumulation cannot be absolute in nature. As rates of economic growth decrease, it must increase until this reduction is overcome by the accumulated productive potential. In the new 5-year planning period, it was noted at the June (1986) Plenum of the CPSU Central Committee, the share of the accumulation fund in the national income is to increase to 27.6 percent, which will make it possible to substantially increase the absolute size of capital investments. For the national economy as a whole the growth rate of investments will rise from 15.4 percent over the period 1981-1985 to 23.6 percent.

/Equalization of the growth rates of Departments I and II preserves to a certain extent the structure of socialist expanded reproduction./ [in boldface] Recently there has been a considerable aging of the productive potential, and at the same time rates of renewal have been dropping. For instance, over the period 1975-1983 the coefficient of retirement of fixed productive capital in the industrial sector dropped from 1.6 to 1.3 percent, and within that the figure for machines and equipment dropped from 2.4 to 2.3 percent. The planning targets for application of new technology have been fulfilled at a level of 85-90 percent for many years. In a number of cases outdated equipment has not been withdrawn from production when it should have been, and this has tended to increase the relative share of products which have been in production for more than 10 years. Schedules have not been met for renewal of the active part of fixed productive capital. As a consequence more than 30 percent of the installed equipment has been in operation between 10 and 30 years. Equipment has especially aged from the standpoint of energy consumption. The sphere of major overhauls has grown rapidly; its value reached 35 billion rubles. A fourth of the country's stock of machine tools and a labor force of 6 million are employed here. But major repairs and overhauls signify only reproduction of outdated use value.

The slow renewal of fixed productive capital has brought about an employment of manual labor on a larger scale, and that in turn has checked the rise of labor productivity and at the same time brought about an increase of wages (in order to attract manpower to jobs of this kind). The upshot was a certain violation of the balance between the growth rates of labor productivity and wages. At the same time this resulted in a large number of job vacancies (at the present time, as noted at the June (1986) Plenum of the CPSU Central



Committee, there are about 700,000 job vacancies in the industrial sector alone assuming one-shift operation of equipment). But predominant growth of the means of production is not the cause of the overaccumulation of means of labor,<sup>17</sup> but the tardy retirement of outdated equipment from production, its operation beyond its rated life.

The convergence of the growth rates of Departments I and II of social production as they decrease is the cause of the slowing down of the growth rates of labor productivity. For instance, the average annual growth rate of labor productivity in the industrial sector of the USSR fell from 6 percent over the period 1971-1975 to 3.2 percent over the period 1976-1980 and to 3.1 percent over the period 1981-1985. At the same time the leveling out of the level of labor productivity in the industrial sector between the USSR and the United States came to an end. Whereas in the sixties labor productivity in USSR industry came nine percentage points closer to the U.S. level, in the seventies, when this process began, it gained two points, and in the early eighties the relation stabilized.

Thus, /convergence of the growth rates of the two departments of social production as a consequence of the dropping growth rates of Department I is holding back the retooling of production and is resulting in widespread employment of outdated equipment and slow renewal of the active portion of fixed productive capital, which as a consequence is holding back the rise in the efficiency of social production/ [in boldface].

But the convergence of the growth rates of the two departments does not do away with the operation of the law of predominant growth of production of means of production. In the present stage of socioeconomic development the group of tasks which can be performed only through the fullest utilization of this law is becoming broader. What are the factors that will predetermine faster growth rates of Department I in the future? These are above all the strategic course of the party's economic policy toward acceleration of the country's socioeconomic development, which signifies above all a rise in the rates of economic growth. "The question of rates," it was stated at the 27th CPSU Congress, "has always been and remains one of the central questions in the party's economic policy."<sup>18</sup> But the conception of acceleration cannot be realized if the bulk of the social product--means of production--is produced in the context of low rates. The need for faster growth rates of Department I is also predetermined by the need to build new productive potential, since the present material and technical base of production does not fully correspond to the goals of acceleration of the country's socioeconomic development. The 27th CPSU Congress set the task of creating by the year 2000 a new economic potential approximately equal to what was built up over all the previous years of Soviet power, and it would be built to conform to the last word of science.

The predominant growth rates of Department I of social production are also a necessity because of the task of a major rise in the productivity of social labor, which in accordance with the decisions of the 27th congress is to increase 2.3-2.5-fold by the year 2000. But the rise of labor productivity is achieved first of all by increasing the equipment-labor ratio. It therefore follows that the rise in the productivity of labor necessitates "...securing

the material basis of large-scale industry: developing the production of fuel, iron, machinebuilding, and the chemical industry,"<sup>19</sup> that is, accelerating the growth rates of the production of means of production.

The predominant growth of the production of means of production is also predetermined by the existence of a sizable sphere of manual labor which is in need of intensive primary mechanization. About 50 million persons are at present employed at manual labor: approximately a third of the workers in the industrial sector, more than half of those in construction, and three-fourths in agriculture. The task has been set for the 12th Five-Year Plan of achieving a faster reduction of manual labor and of reducing its share in the production sphere to 15-20 percent. The task of full mechanization and automation of production is to be performed in the future.

Development of the material and technical base of the agroindustrial complex also dictates the necessity of predominant growth of the production of means of production. At the present time deliveries to agriculture of certain types of resources (various agricultural machines, fertilizers, and so on) are below the requirement. Kolkhozes and sovkhoses have not been fully supplied with grain-harvesting combines, and it is not uncommon for the machines arriving to be of low quality. As a consequence the harvesting of grain takes 22-25 days, whereas the optimum period would be 7-8 days. All of this is causing large losses of grain and other agricultural products.

/Thus the particular features of the country's socioeconomic development in the present stage and of the task for the future indicate an increase in the role of the predominant growth of Department I of social production./ [in boldface]

But it is not legitimate to reduce acceleration of socioeconomic development solely to increasing the rates of economic growth and to overlook a second aspect in its content, which consists of the new quality of growth. "The essence of the changes," it was said at the 27th CPSU Congress, "lies in moving the center of attention from quantitative indicators to quality and efficiency...."<sup>20</sup>

The qualitative growth of Department I of social production is manifested above all in the predominant growth of the manufacturing industry as compared to the extractive industry. For instance, over the period 1970-1983 industrially produced means of production increased 2.72-fold, and industrial subjects of labor 1.87-fold. In the 12th Five-Year Plan the volume of production in the manufacturing industry will increase 25-28 percent, while the output of the fuel and raw materials branches will increase 11-13 percent. As a consequence the relative share of manufacturing branches in industrial output will increase from 75.1 to 77.3 percent.

An important factor in the new quality of growth is the predominant development of those branches which determine scientific-technical progress, of machinebuilding above all.<sup>21</sup> In the 12th Five-Year Plan capital investments in the machinebuilding complex will grow by a factor of 1.8. More than a third of the active part of fixed productive capital is to be renewed. The volume

of retirement of the active part of fixed capital is to be twice as high as in the 11th Five-Year Plan. The volume of output of machinebuilding and metal manufacturing will increase by a factor of 1.43. At the same time the growth rates of machine tool building, computer production, instrumentmaking, and the electrical equipment and electronics industry will be 1.3-1.6-fold faster than that of machinebuilding as a whole.

The qualitative growth of Department I of social production will be manifested in the development and growth of the output of highly economical equipment that guarantees realization of the course toward resource conservation, which is becoming the decisive source for meeting the growing requirements for materials, fuel, and electric power. In the current 5-year planning period more than a fourth of the growth of the national income is to be achieved by conservation. By the year 2000 energy intensiveness of the national income is to be reduced by a factor of 1.4, and its metals intensiveness by a factor of 2. In the 12th Five-Year Plan application of progressive base technologies is to increase 1.5-2.0-fold, and fundamentally new technologies (electron-beam, plasma, pulse, biological, radiation, and other technologies) are to be widely applied in the economy.

Thus realization of the course which has been set toward acceleration of the country's socioeconomic development predetermines both the quantitative and also qualitative development of the production of means of production.

The predominant growth of production of means of production is traced over the length of the entire history of socialist construction. Higher growth rates of Department I than for Department II guarantee performance of the task of accelerating scientific-technical progress, which is the most important condition for increasing the efficiency of social production. Acceleration of the country's socioeconomic development necessitates enhancement of the role of the law of predominant growth of production of means of production both in the theory of socialist expanded reproduction and also in the practice of building socialism.

#### FOOTNOTES

1. The law of predominant growth of production of means of production is operative under capitalism and socialism and is consequently a general economic law. But the socioeconomic consequences of its operation and use differ radically in these two socioeconomic formations.
2. V.I. Lenin, "Poln. sobr. soch." [Collected Works], Vol 1, p 100.
3. "This conclusion could be reached...on the basis of the law that constant capital has a tendency to increase faster than variable capital: the principle that means of production grow faster is a simple rephrasing of this law in reference to social production as a whole." V.I. Lenin, "Poln. sobr. soch.," Vol 1, p 80.

4. S.P. Pervushin, "Kriterii i faktory intensifikatsii proizvodstva" [The Criteria and Factors of the Intensification of Production], Moscow, Znaniye, 1984, p 19; V. Kudrov and V. Shapiro, "On the Relation Between the Two Departments of Social Production in the USSR," VOPROSY EKONOMIKI, No 4, 1973, p 52.
5. V.I. Lenin, op. cit., Vol 4, p 48.
6. K. Marx pointed out that "when the productive force is developing rapidly, all the old machines must be replaced by more profitable ones." K. Marx and F. Engels, "Soch." [Works], Vol 25, Pt II, p 342.
7. Noting the relation between the rise of labor productivity and the quantity of the means of production, K. Marx wrote: "...The social level of the productivity of labor is expressed in the relative quantity of the means of production...." K. Marx and F. Engels, "Soch.," Vol 23, pp 635-636.
8. V.I. Lenin, op. cit., Vol 1, pp 78, 81.
9. V. Romitsyn, "On the Foundations of the Predominant Growth of Production of Means of Production," EKONOMICHESKIYE NAUKI, No 2, 1974, p 23.
10. L.I. Dovgan, "O tempakh rosta dvukh podrazdeleniy obshchestvennogo proizvodstva" [On the Growth Rates of the Two Departments of Social Production], Moscow, Ekonomika, 1965, pp 68-69.
11. E.P. Gorbunov, "Struktura i effektivnost obshchestvennogo proizvodstva" [The Structure and Efficiency of Social Production], Moscow, Mysl, 1974, p 145.
12. S.S. Shatalin, "Funktsionirovaniye ekonomika razvitogo sotsializma" [The Functioning of the Economy of Advanced Socialism], Moscow, Izd-vo Mosk. un-ta, 1982, p 91.
13. K. Marx and F. Engels, op. cit., Vol 23, p 659.
14. The essence of the law and the forms of its manifestation come together as one. "The form is essential. The essence is formed. In one way or another depending on its essence...." V.I. Lenin, "Poln. sobr. soch.," Vol 29, p 129.
15. S.P. Pervushin, op. cit., p 15.
16. Yu.M. Ivanov, "Sootnosheniye ekstensivnykh i intensivnykh protsessov v rasshirennom vosproizvodstve" [The Relationship Between Extensive and Intensive Processes in Expanded Reproduction], Moscow, Ekonomika, p 30.
17. VOPROSY EKONOMIKI, No 10, 1981, p 116.



18. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza" [Materials of the 27th Congress of the Communist Party of the Soviet Union], Moscow, Politizdat, 1986, p 228.
19. V.I. Lenin, op. cit., Vol 36, p 188.
20. "Materialy...", p 25.
21. "The rates of economic growth depend to a decisive degree on /**machine-building**/ [in boldface]. It is here that the fundamental scientific-technical ideas are materialized, where new implements of labor and machine systems determining progress in other sectors of the economy are created. It is here that the foundations are laid for a broad advance to fundamentally new resource-conserving technologies and higher labor productivity and quality." "Materialy...", p 25.

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## INDUSTRY PLANNING AND ECONOMICS

### MINKHIMMASH'S KHOZRASCHET EXPERIENCE, QUALITY POLICIES

#### Ministry Collegium Meeting Recounted

Moscow IZVESTIYA in Russian 26 Nov 86 p 2

[Article by R. Lynev: "Khozraschet and State Acceptance: A Journalist's Report From the Collegium of USSR Minkhimmash Along With Questions, Figures, and Comments"]

[Text] The first item on the collegium's agenda concerned progress in preparing the sector's enterprises for transition to full cost accounting (khozraschet) and self-financing. The second item was preparation for operation in the context of state acceptance of products produced. Both khozraschet and state acceptance will be introduced in the sector beginning in 1987.

But that is not the only circumstance that brings the two questions, the two important lines of operation, closer together--there are also other connections between them. That is what we will be talking about below. Here at the beginning of our notes we would like to share an impression of the report delivered on the first item by I. Mudragel, chief of the ministry's main economic planning administration, and the statements made by the heads of leading associations and enterprises. The impression is that at the level of general directors and chiefs of staff economic services a serious study has been made of experience with khozraschet at AvtoVAZ and especially in the Sumy Scientific-Production Association imeni M.V. Frunze and that they are ready to take advantage of that experience. But where is the emphasis being put in this connection?

They talked knowledgeably--thanks to training done in the sector--about how from now on the number of indicators that would have to be reported on would be substantially reduced. About how the most important ones would remain. And profit, a sizable portion of which, in accordance with long-term rates, would remain at the disposition of work collectives and would be spent by them to develop production and the social sphere and for material incentives, would become the main indicator, summarizing the others, and at the same time a vigorous incentive for good performance.

They spoke in detail and willingly about the pie running into the many millions, about how it would be divided between the sector and the associations

and enterprises, and if necessary supplemented by long-term bank credits. And although the word "earned" has come into use with the status of a term, principal attention was still paid to how what had been earned could be /spent/ [in boldface]. As though that was the main thing in cost accounting. And the rest would be guaranteed all by itself through the use of profit as the main collective incentive. That presumably is what "earning" comes down to.

But problems with it can arise right here. Which is why V. Moskalenko, deputy general director of the Sumy NPO imeni M.V. Frunze for economics, and the minister V. Lukyanenko warned those attending the meeting about a loose and one-sided conception of the tasks facing the sector.

As a matter of fact, who is going to guarantee that the millions are "earned," when today there are still millions which have not been earned? Above all those who are creating material values: the people at the machine tools, those who operate the drafting machines, and the SAPR's. And an important part of the Sumy experience consists precisely of the lower-level cost accounting, that of the brigade, becoming the basis of "upper-level" cost accounting--at the level of the association. It is by virtue of that that the workers became not simply allies, but active participants in the restructuring.

Or take the designer. He is required to incorporate in the article--as his task is stated in Sumy--not merely the best technical designs, but also designs that will guarantee a reduction of labor inputs, a saving on physical resources, and as a result a growth of profit. "The designer must work for conservation," V. Moskalenko emphasized. That is what makes "earning" a vital matter. As it also is for the production engineer, on whom the progressiveness of standard rates and quotas depends. Only if things are organized this way will technical progress and economic efficiency work to benefit one another.

But it is not only "down below," but also "up above," in the ministry, that the cost-accounting dependence of earnings on performance must operate with the same unswervingness. That might be the result, for example, of operational redistribution of a surplus of metal from the warehouses of some enterprises to meet the needs of others where the plan and profit are in jeopardy. Should this kind of maneuvering of resources be left without an incentive? No, it shouldn't. In just the same way as every penalty imposed on the sector and its enterprises must find a particular person responsible, from the brigade leader to the head of the main administration.

What is the progress in preparing for cost accounting along these important lines? They did not talk about that, unfortunately.

But they did remark in the collegium the activity that has grown recently in another area: the top officials of enterprises and associations have been making more frequent requests that their targets for production costs for next year be eased up--at a time when the logic of cost accounting must on the contrary motivate them to adopt strenuous plans. Requests are coming in from enterprises in Baku that resources be found to help them pay penalties for

rejects. Which means at the very threshold of cost accounting they want security, help. Give. That is what they have become used to. But that after all is not "earning," but "begging."

The question of quality has particular importance. Because of oversights in this area and in spite of all kinds of penalties, the principal injured party today is still the consumer, the state as a whole, which pays a high price, for instance, for the more than 2,000 substandard products produced by the Osh Pump Plant or the 100-percent rejects of products from the "Penzkhimmash" Plant, where a single return carries a cost in six figures. What economy can put up with such things?

But progressive changes are inevitable even here. Today enterprises and associations in the sector are still receiving bonuses for products in the first-quality category, but tomorrow, unless the category is superior, there will be no bonus.

Another big question: Will there be much left for enterprises of the millions in profit they now have a foretaste of if all consumers claim penalties for substandard products, as the new economic conditions encourage them to do?

Thus gradually the connections between cost accounting and quality are being traced ever more vividly. Today the branch is in a state of transition from one qualitative level of performance to another. What was the previous one like? It is sufficient to say that in just the 1st half of the year its technical services issued about 50,000 permits for every kind of departure from technical requirements. That is the scale of the permissiveness at the present time. A special sectorwide program "Technical Progress-90," whose measures have been cleared with consumers, is aimed at a different qualitative level. It calls for increasing the output of products meeting the world level from 29 to 90 percent by the year 1990.

At the same time preparations are being made in the branch for state product acceptance. Beginning next year it will be instituted at 95 leading enterprises in the branch and will extend over 70 percent of the products produced. At 13 plants this kind of procedure is even now beginning to have an impact, V. Fedosov, deputy minister, reported to the collegium, and at the Bobruysk Machinebuilding Plant imeni V.I. Lenin the level of state product acceptance has been raised to 100 percent.

Here is what those who spoke in the collegium had to say about progress in making preparation for state acceptance, about early experience in implementing it, and about the difficulties which have arisen. V. Shterts, chief of the technical inspection department of the "Dneprotyazhbummash" Plant imeni Artem:

"We began by drafting measures for reassessment of technical documentation, to secure equipment for metrology, to take inventory in our stockrooms, and to scrap tools which do not meet the requirements of the GOST. We worked out a procedure for interaction between our engineers and state acceptance representatives. All the questions that arise are taken up weekly in a conference

with the chief engineer. On the eve of state acceptance, in August, we ourselves ran a test on acceptance of products at the level of their requirements. We held what you might call a rehearsal. In October the success was 27 percent of output, and in December we had a passing rate of 60."

V. Nesterenko, general director of the Bobruysk Machinebuilding Plant imeni V.I. Lenin:

"In many respects we were forced to learn from our own mistakes in operating in the new way. And the first mistake was that we did not at the time attribute due importance to such an important matter as developing personnel for state acceptance. We decided that since that agency was being installed over us, then let it be created without us. Now this matter has been corrected. Representatives of Gosstandart have joined our specialists and workers in discovering every departure from the technology and have helped to correct it. What did we mainly have to concern ourselves with during the year? With bringing products into conformity with the technical documentation. During this effort one of the things we encountered was that certain GOST's not only do not work toward quality, but sometimes they even contradict it."

S. Kosykh, general director of the PO "Lenpromarmatura":

"Before: at first there was no great willingness to submit products to representatives of Gosstandart. But a stop was put to that. State acceptance is operating jointly with specialized comprehensive brigades along all lines, and they have been discovering a number of defects. For instance, quite often the workers complain that it is impossible for them to achieve high quality on the machine tools. Then the response to this is the question: How could these machine tools themselves have passed the recent certification? We mean to take a new approach to what is referred to as defect-free submittal. To be specific, to see that the worker is motivated to discover defects in the finished product on his own. What in fact is a finished product? The result. And what that is depends on adhering to the technology. That is why we are striving to pay particular attention to precisely this aspect of the matter."

The minister V. Lukyanenko spoke several times in the discussion.

"I don't much like your comparison," he said, objecting to one of the speakers, "when you say that the head of state acceptance and your chief engineer operate like 'blood brothers.' It is clear that the chief engineer is an important figure in the quality effort. But today, because of the extreme importance of this effort, it must be headed by the director himself, and he must be in constant contact with the top officials of state acceptance. Personally."

"I do not understand your complaints," he said, correcting another speaker, "that now that the state acceptance authorities have been assigned the best specialists, with high salaries, your own technical inspection department has been stripped bare, since remuneration is lower there. Staffs and remuneration, I must remind you, are today your affair, not ours, not the business of the ministry. This is a matter of your economic independence. So you work it



out as cost accounting requires you to do. Incidentally, in the Frunze Association the technical inspection department has always been considered one of the strongest staff services. Even recently it has been headed by a competent specialist who previously was a chief designer. In my opinion, that says a lot."

And yet another typical remark of the minister's:

"In developing the personnel for state acceptance and in strengthening technical inspection departments please pay attention to structural redundancies, bulges, which are unjustified in true cost accounting. The necessary units need to be strengthened in every way by cutting back those which are unnecessary."

Cost accounting and quality. The close relation between them is normal and natural. Anyone who separates these concepts is not thinking, if we may put it this way, in fully economic terms.

#### Product Quality Turned Upward

Moscow EKONOMICHESKAYA GAZETA in Russian No 48, Nov 86 p 7

[Article by Ye. Babak: "Acceptance After 6 Weeks"]

[Text] The plant submitted its products to the Gosstandart commission after the fourth inspection. The collective has made quite a few efforts to manufacture high-quality products.

"In the assembly shop of the 'Krasnyy Proletariy' Association they had just finished making one in a series of machine tools. A lathe with numeric programmed control. Products of this kind represent the bulk of the output of 'Krasnyy Proletariy.' Before shipping the machine tool to the customer, it goes through every kind of test. The last stage is to machine a steel workpiece on it. The inspectors determine the roughness of the surface machined and the existence of geometric deviations by means of special instruments.

"This time everything is in order," says V. Kokin, official of the Moscow Center for Standardization and Metrology. "The machine tool was accepted on the first submittal."

The presence of V. Kokin in the assembly shop is explained by the fact that since May of this year special conditions for acceptance have been instituted at the enterprise. In other words, the final decision on the quality of the machine tool is not being made by the technical inspection department, but by a representative of Gosstandart.

Special acceptance conditions are an exceptional measure. They are instituted in the case when an enterprise is unable to guarantee stable output of high-quality products. That is the conclusion reached by the commission of the Moscow Center for Standardization and Metrology and the USSR People's Control Committee when it made a thorough inspection of the enterprise. Enumeration

of product defects took up an entire page. The workpieces machined on the machine tools being tested did not meet the specifications of the standard either with respect to the roughness of the surface or with respect to geometric parameters. During the tests assemblies of the machine tool broke down, and the electronic devices malfunctioned.

To make things clear representatives of Gosstandart decided to draw a chart on daily acceptance of machine tools. They entered in red the number of products accepted on the first submittal, blue for those accepted on the second, and black for those accepted on the third. June was almost completely blue (there was also some black). But it turned out that three colors were not enough: even on the third submittal all the machine tools had not passed. In short, in the early going only 8 passed per day instead of 25. In May and June the plant did not fulfill the plan for the first time in many years.

There is one point that needs to be stated precisely here: Those very products of "Krasnyy Proletariy" which are not meeting the standards have been certified to bear the state Quality Emblem. Nor was it removed from the products even after the critical conclusions of the commission. This was, of course, more than obvious to Gosstandart. But the very fact that the prestigious pentagon is fixed to a machine tool that was accepted on the third submittal does not enhance the prestige of the Quality Emblem.

To the collective's credit, the situation was evaluated in a spirit of self-criticism. The questions of quality were discussed in a session of the party committee and shop conferences. Gosstandart representatives remarked that the people there were responding quickly to all their criticism. They instituted additional inspection between operations, and they set up special test stands. And in 5 months product quality had improved noticeably.

But why were there so many defects and why did they occur only after the check was made? Perhaps previously the enterprise was manufacturing different machine tools? One of the workers answered the question this way: "The machine tools are the same, it is the times that are different now."

"Of course, we did not consider ourselves infallible at all, but we had no idea that things were so bad," G. Davydov, former chief of the plant research laboratory, admits (he now heads another staff service).

By no means can it be said that they were not paying attention to quality in the association. For example, they had a comprehensive quality control system in effect. It envisaged among other measures socialist competition for product quality, a higher percentage of bonuses for workers when parts were accepted on the first submittal, and the best of them were granted the right to submit products in agreement with the technical inspection office. The central plant laboratory and reliability office were concerned with questions of quality. Nevertheless, the result was discouraging. Consequently, the work was being done as a formality....

"For a long time our principal goal was the plan for gross output," said Yu. Kirillov, the association's chief engineer. "It seemed unthinkable not to meet it."

A considerable number of claims coming back to the enterprise had to do with failures of electronic systems. Literally everyone knows about this--from the worker to the director. No one compelled the association to take unsuitable components. But what does it mean to display a devotion to principle? Once again to threaten fulfillment of their own plan, of which those with whom they do business are fully aware.

After the special conditions were instituted, the first thing they did was to strengthen inspection of incoming components; they filed penalty claims against the manufacturers of the components--enterprises of Minpribor. In addition, the enterprise insisted on replacement of several reluctant suppliers. These measures proved to be effective, and the suppliers were disciplined. For them a future in which their own rejected products would pile up became quite realistic.

Incidentally, at certain enterprises of Minpribor state acceptance was recently organized, and this was immediately felt by the consumers of their products: there began to be interruptions in deliveries. Obviously they were prevented from selling substandard products.

To be sure, not all enterprises of Minpribor were brought into line. The production associations "Kontur" (Tomsk), "Telemekhanika" (Nalchik), "Iskra" (Smolensk) are still sending out electronic systems which are far from perfection to put it mildly. There are things there for their design and process engineering departments to think about.

It is right and natural that even at "Krasnyy Proletariy" there recently have been more objections addressed to the design department and technical inspection department, that is, to those sections on which quality depends first of all. Everyone knew about this, but they did not wish to put things in order there.

Now a new structure of the technical inspection department and a new table of organization have been worked out at "Krasnyy Proletariy." In every section the average rating of inspectors must be higher than the average rating of the workers. The wages of someone with a master rating in the technical inspection department has been brought up to the level of someone with a master rating in production engineering. All of this is being done, of course, with the enterprise's resources.

But by no means do they plan in the association to achieve a radical improvement of quality solely through strict inspection.

The quality of products begins with the quality of the design. That is why at "Krasnyy Proletariy" they intend to strengthen the design department, to use every opportunity the government has granted to put order in the wages of engineering and technical personnel.

A reliability department has been created (it brings together the central plant laboratory and a portion of the department of the chief electronics specialist. The purpose of the department is to test the products produced in



every way. Changes are being made in the system for material incentives of the enterprise's workers. For a long time it depended mainly on fulfillment of quantitative indicators, even in the case of inspectors of the technical inspection department. Now product quality will be the principal criterion in the bonus system.

The association's designers have been set the task of creating new lathes and robots and then robotized systems based on them. These products will meet present-day requirements from the very beginning.

"Krasnyy Proletariy" now has its most difficult time behind it. The number of machine tools accepted on the first submittal is increasing steadily. It has already reached 90 percent at the present time. This means that the enterprise's business managers and party committee have much to do to mobilize the collective to raise product quality. But no longer will the conditions exist for complacency and for lowering the standards they set for themselves: beginning with the new year state acceptance is being organized at "Krasnyy Proletariy."

It turns out that it is possible to increase output without detracting from quality, which is what they feared in the association. If, of course, the fight for quality does not turn into a short-term campaign, but is waged painstakingly and according to a plan.

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# INDUSTRY PLANNING AND ECONOMICS

## MACHINE BUILDING PRODUCT OUTPUT FOR 1975-1985 COMPARED

Moscow PLANOVoye KHOZYAYSTVO in Russian No 11, Nov 86 pp 99-103

[Article prepared for press by V. Kalashnichenko and T. Konik: "Production Dynamics for the Basic Types of Machine Building Products"]

[Text] In the 11th Five-Year Plan machine building production volume increased by 36 percent compared with a 152 percent increase in the 10th Five-Year Plan. This was caused mainly by a decrease in the production growth rate in a majority of machine building sectors, particularly instrument building, the motor vehicle and electrical engineering industry, and others.

The data in table 1 describe the total production volume growth rates for the machine building and metal working sectors in 1981-1985.

Table 1 (as a percentage of 1980).

	1981	1982	1983	1984	1985
Machine Building and Metal Working...	106	111	118	126	135
Machine Building.....	106	111	118	127	136
Power Machine Building.....	103	110	117	125	133
Metallurgical Machine Building...	100.4	104	108	111	118
Mining Machine Building.....	103	107	113	118	123
Materials Handling Machine Building.....	102	106	108	112	118
Railroad Machine Building.....	101	104	108	114	119
Electrical Engineering Industry..	105	107	112	117	123
Chemical and Polymer Machine Building.....	101	107	113	123	133
Oil Industry and Geological Research Drilling Equipment Production.....	107	113	126	133	138
Oil and Gas Refining Equipment Production.....	102	108	114	123	133
Paper and Pulp Industry Equipment Production.....	104	107	109	117	121
Machine Tool and Instrument Industry.....	105	111	117	124	133

Table 1 (cont.).

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Instrument Building.....	109	117	127	140	153
including the computer					
equipment industry.....	111	124	137	153	171
Motor Vehicle Industry.....	105	108	111	116	122
Tractor and Agricultural					
Machine Building.....	104	108	114	120	128
Road Construction Machine					
Building.....	104	105	107	111	115
Building Materials Industry					
Equipment Production.....	100.7	104	107	114	120
Light Industry Industrial					
Equipment Production.....	104	108	114	120	125
Food and Mixed Feed Industrial					
Equipment Production.....	100.7	99.9	105	111	117
Metal Structures and Products					
Industry.....	105	108	115	121	130

Table 2 displays power and electrical engineering equipment production.

Table 2.

	<u>1975</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Turbines:							
thousands of units.	0.4	0.5	0.5	0.5	0.5	0.5	0.5
millions of kilo-							
watts.....	18.9	19.6	14.6	17.3	15.5	21.3	21.6
Steam Boilers with a							
productivity of over							
10 tons of steam per							
hour, in thousands of							
tons of steam per hour.	55.6	51.0	53.1	43.1	50.8	46.5	43.7
Diesel Engines (ex-							
cluding motor vehicle							
and tractor ones), in							
millions of horsepower.	18.6	19.0	18.7	18.6	16.3	16.1	16.6
Turbine Generators, in							
millions of kilowatts..	17.1	16.1	13.9	12.7	12.6	13.7	13.3
Large Electrical Mach-							
inery, including sub-							
mersible motors, in							
thousands of units.....	24.0	33.4	35.1	36.0	37.8	39.9	42.2
Direct current motors							
with a capacity over							
100 kilowatts:							
thousands of units.	35.5	38.0	38.1	38.0	36.9	39.1	39.9
millions of kilo-							
watts.....	7.0	7.7	7.7	7.7	7.6	8.0	8.2



Table 2 (cont.).

	<u>1975</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Direct current motors with a capacity of from 0.25 to 100 kilowatts:							
thousands of units.	8026	9412	9617	9571	9637	9265	9279
millions of kilo- watts.....	34.7	39.9	40.6	40.7	40.4	40.6	41.2
Power Transformers, in millions of kilovolt amperes.....	137	159	161	161	155	156	161
Electric Lights, in millions of units.....	2050	2172	2223	2269	2410	2462	2470

Table 3.

	<u>1975</u>	<u>1980</u>	<u>1981</u> <sup>1</sup>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Metallurgical Equip- ment:							
blast furnace							
thousands of tons..	124	124	119	111	128	123	131
millions of rubles.....		44.1	<u>42.1</u> 46.6	54.6	59.3	58.2	62.9
steel smelting							
thousands of tons..	63.4	73.1	70.1	66.1	64.2	62.2	66.0
millions of rubles.....		44.2	<u>39.4</u> 42.8	47.1	44.2	44.0	45.6
rolled							
thousands of tons..	154	155	154	146	145	141	151
millions of rubles.....		197	<u>202</u> 218	217	222	219	245
including machinery and equipment for continuous blank casting:							
thousands of tons..	22.1	22.2	27.9	25.4	26.1	25.3	29.8
millions of rubles.....		28.6	<u>35.5</u> 38.2	38.3	37.9	36.0	44.1
Petroleum Equipment, in millions of rubles..	123	201	<u>198</u> 209	210	208	211	229
Chemical Equipment and spare parts for it, in millions of rubles.....	576	731	<u>712</u> 750	762	814	854	936

<sup>1</sup>Production data, considered in terms of cost, have been presented in two prices for 1981: in the numerator--in the wholesale prices of enterprises for 1 January 1975, in which data have also been presented on production for previous years; in the denominator--in wholesale prices of enterprises for 1 January 1982, which has considered production beginning in 1982.

In chemical and petroleum machine building, the production of advanced equipment types for the chemization of the national economy will be developed and the output of equipment and manufacturing lines of increased unit capacity in a package or block-package design will be increased. The output of metallurgical equipment will be significantly increased and the production of converters with combined blasting and highly productive machines for continuous steel casting will be created and introduced in the 12th Five-Year Plan

The current five-year plan must provide for accelerated development in the production of computer equipment, instrument building, the electrical engineering and electronic industry, and machine tool building. An accelerated 1.3-1.6-fold growth rate in production output in comparison with the machine building average as a whole is being provided for in these sectors.

Instrument, automation equipment and computer equipment production can be seen in table 4.

Table 4.

	<u>1975</u>	<u>1980</u>	<u>1981<sup>2</sup></u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Instruments, automation equipment and spare parts for it--total.....	2748	4638	$\frac{4791}{3841}$	4106	4310	4566	4785
including:							
optical-mechanical instruments and equipment.....	459	800	$\frac{853}{784}$	827	827	802	793
electric meters.....	459	754	$\frac{801}{624}$	589	581	620	638
manufacturing process control and regulation instruments.....	823	1333	$\frac{1399}{1070}$	1146	1230	1319	1384
instruments for physical research...	95	147	$\frac{195}{164}$	166	160	188	215
instruments for measuring mechanical values.....	283	469	$\frac{480}{415}$	431	458	486	503
time instruments (excluding everyday watches).....	38	78	$\frac{82}{73}$	83	56	57	59

Table 4 (cont.).

	<u>1975</u>	<u>1980</u>	<u>1981</u> <sup>2</sup>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
mechanization and automation equipment for administrative and engineering technical work.....	198	286	$\frac{297}{234}$	252	277	306	330
Computer equipment and spare parts for it.....	1921	4500	$\frac{4986}{2660}$	2952	3288	3696	4202

<sup>2</sup>See footnote for table 3.

Machine tool building is often called the heart of machine building. And in speeding up the social and economic development of the country perhaps the main task--sharply increasing technical equipment of all sectors of the national economy--falls on the shoulders of the machine tool builders.

The data in table 5 depict production of the main types of metal working equipment and industrial robots.

Table 5.

	<u>1975</u>	<u>1980</u>	<u>1981</u> <sup>3</sup>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Metal-cutting machine tools:							
thousands of units.	231	216	205	195	190	188	182
millions of rubles.	1359	1944	$\frac{2047}{1960}$	2073	2200	2390	2681
including machine tools with numerical control:							
thousands of units.	5.5	8.9	10.1	10.6	11.4	13.3	17.8
millions of rubles.	193	471	$\frac{545}{458}$	530	607	789	1076
machining centers made up of them, in thousands of units...	0.1	0.7	0.9	1.0	1.4	2.0	2.5
Forging and pressing machines:							
thousands of units.	50.5	57.2	57.1	57.3	57.4	55.3	52.7
millions of rubles.	379	563	$\frac{597}{599}$	621	657	664	660

Table 5 (cont.).

	<u>1975</u>	<u>1980</u>	<u>1981<sup>3</sup></u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Automatic and semi-automatic lines for machine building and metal working, in complete sets.....	736	814	832	792	956	1068	1084
Industrial robots, in thousands of units....	0.1	1.4	2.5	4.5	8.7	11.1	13.2

<sup>3</sup>See footnote for table 3.

The production (in quantity) of metal-cutting machine tools has decreased somewhat in recent years but the output of advanced types of them has increased. In 1981-1985, with a 16 percent decrease in the total number of machine tools manufactured, production of such tools with numerical control doubled, including a 3.3-fold increase in the machining center type.

The output of automatic and semiautomatic lines for machine building and metal working increased by 33 percent in the 11th Five-Year Plan, amounting in 1985 to 1084 units. Some 13,200 industrial robots were manufactured in 1985 and their production will double in the 12th Five-Year Plan.

Table 6 presents the structure of metal-cutting machine tool output.

Table 6 (in thousands of units).

	<u>1975</u>	<u>1980</u>	<u>1985</u>
Metal-cutting machine tools--total....	231341	216206	181752
including:			
Lathes.....	41197	34630	22590
Turret lathes.....	6475	4906	3390
Automatic and semiautomatic lathes..	5692	5334	4123
Milling machines.....	22807	20850	15909
Gear-processing machines.....	3911	3051	2183
Boring machines.....	2763	2474	2047
Planing and grooving machines.....	4698	5082	3389
Broaching machines.....	379	450	361
Polishing machines.....	14040	11567	9775
Sharpening-polishing and rough-grinding machines.....	17561	16818	14740
Sharpeners.....	7513	6433	4426
Drill presses.....	52264	43140	35658
Special, specialized and aggregate machines.....	38801	49891	49666
Others.....	13240	11580	13495



More than 40 percent of the metal-cutting machine tools now manufactured are in the category of lathe, drilling, and milling machines, i.e., producing a bulk of shavings. The proportion of polishing and buffing machines does not exceed one-fifth of production. In accordance with approved amortization allowance norms, the yearly write-off of metal-working equipment in machine building, while preserving a stable stock, must amount on the average to 5-6 percent a year, and in fact only 3 percent was written off in 1985.

In the years 1976-1985, the growth in machine building production output was accompanied by its replacement. During the 10th and 11th Five-Year Plans, 27,000 models of new types of machines, equipment and devices were created, including equipment permitting total mechanization and automation not only of individual sectors and shops but also of enterprises as a whole; about 18,000 obsolete designs of machines, equipment, devices and products of machine building have been removed from production. In 1985, out of 2,600 models of new types of machines, equipment and devices, 15 percent were electrical engineering equipment, 10 percent metal-cutting machine tools, and 8.5 percent chemical and compressor pump equipment. Some 7,200 industrial enterprises and more than 100,000 sectors, shops and plants were fully mechanized and automated.

In 1980, the proportion of machine building products introduced into the country for the first time amounted to 2.9 percent of the total commodity production volume, and in 1985 this figure was 3.1 percent. A growth in this indicator to 13 percent is envisioned in the 12th Five-Year Plan.

Table 7 presents a number of new types of machine building products introduced into the USSR for the first time.

le 7.

	<u>1976-1980</u>	<u>1981-1985</u>	<u>1985 alone</u>
Machines, equipment, devices, instruments, automation equipment and machine building products....	13727	15669	3527
they include:			
machines, equipment, and devices including by equipment types:	9332	9381	2249
electrical engineering equipment..	1698	1470	300
metal-cutting machine tools.....	732	898	178
forging and pressing equipment....	215	157	27
casting equipment.....	26	60	6
metallurgical and mining equipment.....	215	284	59
motor vehicles, tractors, motor vehicle and tractor equipment and agricultural machinery.....	479	307	82
chemical and compressor pump equipment.....	860	968	249
light industry equipment.....	233	362	81
food industry equipment.....	178	277	84
Instruments, automation and computer equipment.....	2744	3779	615

To carry out the task which the 27th CPSU Congress set before machine building--to renovate production primarily based on retooling and modernizing it, and increasing the level of mechanization and automation--the growth rate for the sector's production volumes must be accelerated and the quality of the manufactured items must be significantly improved.

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## INDUSTRY PLANNING AND ECONOMICS

### DMITROV MILLING MACHINE PLANT'S GOALS, PROBLEMS

#### Dmitrov Plant Modernization Obstacles

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 9 Dec 86 p 2

[Article by L. Skoptsov: "Amendments to the Minister's Order--A Letter from the Dmitrov Milling Machine Plant"]

[Text] Today the Dmitrov Milling Machine Plant manufactures quite simple and inexpensive universal machines. In 1992--only five years from now!--it must provide the country with 500 of the most modern machining centers and 200 flexible manufacturing modules. The task, it cannot be denied, is within the realm of possibility. There is one way to go: to closely coordinate the interests of production, the collective and each worker.

I. Ordinartsev paid the first visit after the meeting of the enlarged Minstankoprom/Ministry of the Machine Tool and Tool Building Industry/ board in Ivanovo to the Milling Machine Plant at Dmitrov. One can only guess what the first deputy minister felt, correlating the Ivanovo impressions with the dilapidated legacy from the Kanalstroy/Canal Construction Trust/ era. Although a proper individual, Ordinartsev did not control himself on this occasion: "This is not a plant but a collection of dog kennels."

They started to construct the building from brick here only in 1946. And a plant settlement started to grow along the other side of the Moscow-Dubna highway. The plant and settlement fell apart over the years and the sheds and barracks gave way, though not fully, to brick shops and "self-constructed" paneled buildings. Both its pluses and its minuses are still felt. On the one hand, a skilled worker's collective has been put together and a sensible engineering building has been chosen. On the other hand, the plant was not built in an integrated way, never was made integrated, and was not modernized. Therefore, as long as as 1970 they spoke about the necessity for a radical modernization and retooling of the plant.

Proposals and justifications--many times and always with understanding--were considered in Minstankoprom and Gosplan/State Planning Committee/. Time after time the hopes for quick about-to-happen future changes collapsed. An insurmountable barrier has arisen in the path of the necessity for change--and

still stands--the "6R" series line. To be more precise, we mean the orders of the national economy for an obsolete universal machine tool which does not provide a modern level of precision but, on the other hand, is inexpensive (a basic price of 2,500 rubles) and simple.

In the 11th Five-Year Plan only two plants--Dmitrov and Gorkiy Milling Plants, sent customers more than 47,000 of these machine tools--and did not satisfy the demand.

This is the paradox: a series production which enjoys, judging by the portfolio of Gosplan orders, a huge customer demand is ruinous to the plant. At the beginning of next year the time period for the "6R" line specifications expires. The plant will allot more than four million rubles in the state budget for fines. For what? For the production of obsolete products...! Direct losses in monetary incentive funds will amount to 560,000 rubles, in social and cultural funds--280,000, and in development funds--365,000. This is already an appreciable blow to the pocket of every worker. "The IIR/engineering and technical personnel will begin to scatter," predicts the chief of the planning and economic department S. Romin. "With small salaries, a progressive piece-rate system of wages means a lot to them." It turns out that the first to leave will be the young, intelligent lads from those whom the chief technologist Boyenkov selected for the future modernization, those he fished out of the technical college corridors of Moscow, Kalinin, Tula.

The owner of the plant--Glavstankoliniya/Chief Administration of Automatic Lines and Standard Machine Tools--is new: even recently the Dmitrov Milling Plant was under the jurisdiction of the VPO Soyuztyazhstankoprom/Heavy and Unique Machine Tools Industrial Association. However, the chief of Glavstankoliniya O. Albul is in the midst of plant problems. This is how things appear from his office. The rigid manufacturing method must be changed to a flexible one, production must be retooled and volume tripled with the same number of workers. Retooling will begin in 1987 and plant expansion in 1989-1990. Minister V. Panichev has signed the order, funds have been allotted, and the contractors and subcontractor plants have been determined. The "6R" line is being removed from production in the second half of next year.

Thus, there is a lofty and socially significant goal. What else is needed? Conditions for achieving it are required. They must be clear and specific ones converting the goal into a concrete task. So the conditions are exactly contradictory and therefore the situation is becoming vague. The very same number of old machine tools is being set for the plant in the 1987 plan. The telegram with this ruling was signed by O. Albul himself.

Why doesn't the left hand know what the right is doing?

It does know, but the left is oriented toward Gosplan and the right toward Gossnab/State Committee for Material and Technical Supply. Their portfolio is packed as usual with requests for universal machine tools. Gosplan requires them from the ministry. And where must the ministry get them? Where they have always been made, at the Dmitrov Milling Machine Plant.



So the Dmitrov machine tool builders found themselves in the middle of national economic development contradictions.

"All modernization plans have to be moved back a year or two," the plant planners feel. "But what about the fines? We are guilty without fault."

However, they are firmly convinced in Glavstankoliniya and Mosoblplan/Moscow Oblast Planning Commission/ that the modernization will take place on time and to the fullest extent. However, there is no such confidence and there cannot be such at the present time among the ordinary participants in the rebuilding project. One year of the years allotted to it has already passed. The question about deliveries and the 1987 plan is still open. This worries people.

If the work of the chief specialists has been concerned with rebuilding production, then the party committee is concerned with the mood of those who will carry it out. Since the prospects for next year are hazy, the meeting of the party economic aktiv which was prepared a long time ago has had to be postponed from month to month. At it each step must be worked out in detail--a strategy must be determined for each one and a staff for the daily management of modernization progress must be created. This aktiv meeting is very much awaited. Psychological preparedness, a requirement for rebuilding, is being experienced by each person at the plant. This is no overstatement. The past does not suit everybody equally. The next letter will address this.

#### Dmitrov Plant's Conflicting Orders

Moscow LENINSKOYE ZNAMYA in Russian 5 Oct 86 p 2

[Article by N. Popov, under "Scientific and Technical Progress: Experience and Problems" rubric: "An Official Ministerial Document for a Simpleton"]

[Text] The article "No, It Will Not Happen This Way" was published in LENINSKOYE ZNAMYA on 11 February 1986. It said that the 15 machine tool versions which the Dmitrov Milling Machine Plant manufactures were deprived of the State Emblem of Quality. The collective was faced with the necessity for a choice: to reorganize on the output of advanced equipment or to remain in the backwoods of scientific and technical progress.

Seven months have passed since the publication of the article but Minstankoprom/Ministry of the Machine Tool and Tool Building Industry/ never answered the newspaper's statement. What has been changed at the plant? Is the future of production development clear today.

To find out about this, our correspondent went to the plant again.

Thunder from a clear sky would not have startled the Dmitrov machine tool builders more than the telegram from USSR Minstankoprom. It read: "After consideration of the 1987 draft plan in the machine tool building department of USSR Gosplan/State Planning Committee/, it was determined that your plant would manufacture milling machines--3,190 of them..."

The telegram was received on 15 July 1986. Keep this date in mind in order to understand better the connection of events in our story.

So why did an ordinary at first glance business telegram from the ministry plunge the Dmitrov machine tool builders into despair?

The fact is that for a year and a half the Dmitrov Milling Machine Plant jointly with the Ryazansk division of the institute Giprostanok/State Institute for the Planning of Machine Tool, Tool and Abrasives Plants and Forging-and-Pressing Machinery Plants], the NPO Orgstankinprom/Scientific and Industrial Association of the State Planning, Technological and Experimental Institute for the Organization of the Machine Tool and Tool Industry], and other organizations has been developing a program to introduce the manufacture of highly productive machining centers, flexible production modules, special machine tools and automatic lines.

To carry out this program it is necessary to cut universal milling machine output in half in 1987--to manufacture 1,500 instead of 3,000 units and then to give up making them altogether.

The new line of series electronic bracket milling machines differs fundamentally from the universal ones. They have an automated table movement cycle, use a tool-gripping mechanism, have an increased machining area and an enlarged range of speeds and feeds. In terms of productivity, 1,200 new machine tools exceed 3,000 of the old ones. The latest achievements in world machine building are embodied in them.

They expect to manufacture the new machine tools with an advanced flexible technology.

So the directive contained in the Minstankoprom telegram gives up all hope of doing this. However, it is not the hope alone.

A production preparation planning schedule was developed in accordance with a program of shifting to the output of more highly productive equipment at the plant. Equipment accessories were designed, metal of a specific type was ordered from suppliers, and units were supplied on a cooperative basis. The equipment has already been received. What is to be done with all of these goods?

The USSR Minstankoprom order "Measures to Increase the Output of Highly Productive Machining Centers, Flexible Production Modules, Special Machine Tools and Automated Lines at the Dmitrov Milling Machine Plant," published last month, has not cleared up the situation. The telegram was received, as we recall, on 15 July. The order was signed on 21 July 1986. It was based on a program to rebuild and enlarge the Dmitrov plant and it provides for, as was shown earlier, the output in 1987 of only 1,500 machine tools of the obsolete "6R" series and the switch in the second half of the year to the "6D" line.

The question arises: to what ministerial finger is the plant's collective subordinated--the "right" or the "left"? When plant director B. N. Kalugin turned to the ministry for an explanation, the chief of the planning and economic department S. S. Sergeyev answered him in the following way.

"An order is an order, and in 1987, as it was pointed out, you are obliged to manufacture 3,190 universal machine tools."

The question comes up: why then was the unfulfilled order deliberately issued? Apparently, they counted on the fact that the plant collective would not particularly look into the tangle of ministerial directives and that, just like the ministry itself, would regulate its life without changes. It all turned out otherwise.

Rebuilding cannot be accomplished by orders alone. People are a necessary ingredient in its accomplishment and that is why they are not at all indifferent to it. Thus, the ministerial order in our case is an official document meant for a simpleton. However, it did not find an addressee. The plant collective decided to fight for its fate. The order was meant to cover people in case of complaints to USSR Minstankoprom concerning the lack of advanced milling equipment: "Excuse me! We issued an order. They must make such machine tools in Dmitrov. There is also a demand from the plant..."

After a chat with the chief of the USSR Minstankoprom planning and economic department S. S. Sergeyev, I only confirmed the fairness of my own conclusions.

In explaining why one thing was written in the order and an entirely different thing in the telegram, he tried to defend the position of his own department and the machine tool building and tool industry department of USSR Gosplan.

"The construction of some industrial enterprises was badly delayed," he says. "They are being constructed according to outdated designs. They need "universals" and small workshops are also taking these machines."

It is hardly necessary to prove what industry needs most today--to equip a workshop with a "universal" or a giant plant with an automatic milling machine? Why 1,500 new machine tools will replace 3,000 old ones with interest.

"Designs already set in motion must be reworked," S. S. Sergeyev held his ground. "But this is not so simple."

Yes, it is complicated. Nevertheless it is simpler to revise a design than to rebuild an obsolete newly-constructed plant. And the main thing is that it is less expensive. By restricting the future development of the Dmitrov plant, they are hindering the retooling of machine building plants.

"But we issued the order, we are behind it."

Yes, let's not take the Minstankoprom workers lightly; they have an excuse for everything. Though it may be absurd, it is backed on the other hand by a document.

The Dmitrov machine tool builder collective has been made resolute.

"The "6R" machine tools which we have been manufacturing for more than 20 years have become outdated," says the secretary of the shop #17 party organization, Galina Konstantinovna Dets, "and it surprises me that there are still enterprises which take this obsolete equipment from us. They are working with an outdated technology. We, instead of helping to speed up scientific and technical progress, are assigning antiquated labor methods to other enterprises. Don't they in Gosplan and Minstankoprom who plan our production output really understand that this production has already become not only yesterday's but the day before yesterday's?"

Workers we chatted with also had the same opinion. In particular, N. P. Zharkov who services machine tools with numerical control observed:

"As far back as the beginning of the 11th Five-Year Plan our plant developed the "6D" advanced machine tool line in place of the "6R" series. At that time the planning organs did not give us an opportunity to manufacture them and other highly productive equipment. This business has now been slowed down again. How much longer yet must we be in the backwoods of scientific and technical progress?"

I asked the chief of the machine tool building and tool industry department of USSR Gosplan, L. N. Snovskiy, to answer this question. He was disposed to be aphoristic: "Just as everyone needs not only a fashionable pair of shoes, but also work boots, so industry needs "universals" along with the highly productive equipment." But what do boots have to do with it? We are talking about machine tools. So, I will repeat, milling machines are as necessary to machine building today as air. The retooling of plants in various sectors of industry is inconceivable without them. What, moreover, must the Dmitrov machine tool builders undertake? They have already incurred considerable losses by continuing to manufacture technically outdated machine tools. It is doubtful whether the arguments with which USSR Minstankoprom and USSR Gosplan "regaled" me will convince USSR Gosstandart/State Committee on Standards/ not to employ sanctions against enterprises manufacturing outdated products. But both USSR Gosplan and USSR Minstankoprom understand this perfectly. In this case why are mutually exclusive orders issued? They did not want to answer that question for me. They preferred to discuss the benefit of poor boots. It seems that what is more helpful today is to think about the harm of obsolete machine tools.

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## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

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### GOMEL PLANT ON NC TOOL IMPLEMENTATION

Moscow MEKHAIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 10, Oct 86 p 3

[Article by V. S. Lipinskiy, engineer: "Mechanization and Automation at the Gomel Order of the Red Banner Machine Tool Building Plant imeni S. M. Kirov"]

#### [Excerpt] Introduction of NC Machine Tools

Automation insures tangible improvement in the productivity of labor. The use of NC machine tools is the main direction for automating small series production at the plant. The level of the modern development of metal-cutting NC machine tools makes it possible to affirm that the use of such machine tools is one of the basic ways to automate the machining of parts in small series and even in single unit production. The use of NC machine tools is almost the only technically justified solution in the manufacture of parts with complicated shapes.

The basic principle in utilizing NC machine tools is their mass use directed toward the complete reequipping of the plant or, as a first stage, to a comprehensive solution of a certain production problem.

NC machine tools were introduced at the Gomel Machine Tool Plant in 1972. At present, 83 such machine tools are in operation and make up 23.5 percent of the total number of metal-cutting equipment in the enterprise. Practically every fourth machine tool is an NC machine tool.

The consumption of labor in machining parts on NC machine tools is 85 percent of that which makes it economically expedient to change over.

Starting with the introduction of single machine tools, at present all NC machine tools are concentrated in four sections operating in two shifts.

Labor organization problems in production are regulated in a way that determines the duties of workers in the section, established by the services of the plant.

Multimachine tool servicing is introduced in the sections.

Each machine tool operator services 2-4 machine tools. The creation of comprehensive sections of NC machine tools made it possible to incorporate progressive labor organization methods in the best manner. The brigade form of labor organization is introduced in the sections with the wage distribution in accordance with the final result, taking into account the coefficient of labor participation. The adoption of the brigade method facilitates a reduction in the idle time of the equipment.

In the 11th Five-Year Plan period multioperational machine tools of the machining center type (OTs) began to be introduced at the plant. At present, 12 OTs are in operation at the plant.

The concentration of operations at NC machine tools produces maximum utilization of the advantages of these machine tools and leads to a minimum share of manual labor. In the 12th Five-Year Plan period, it is planned to introduce about 12 more OTs.

The introduction of NC machine drilling tools for the comprehensive machining of housing parts made it possible to eliminate manual labor fully for finishing parts in the assembly shop.

The introduction of a robotized turning complex (RTK) is a large reserve in improving the productivity of labor and raising the degree of automation of NC machine tool sections. Such RTK consist of an NC machine tool, an industrial robot and an intermediate product storage unit. A four RTK section is being introduced at present. The introduction of these complexes will make it possible to accumulate experience in organizing the servicing of such equipment so that the introduction of mass RTK will be implemented.

Operating 83 units of NC equipment requires the timely and quality development of control programs. An automatic work position of a technologist-programmer (ARM TP) "ISKRA-226" is being introduced at the plant to solve the problem of automating the development of control programs. The introduction of ARM TP will ease the labor of programmers considerably and will improve the quality of the development of the control program.

The introduction of NC machine tools at this stage is a most important direction in automating production at our plant.

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## OTHER METALWORKING EQUIPMENT

### ROLE OF URALMASH, NIITYAZHMASH IN INTENSIFICATION PROGRAM

Moscow KRASNAYA ZVEZDA in Russian 8 Aug 86 p 2

[Unattributed article under the rubric "Socio-Economic Sketch": "The Plant Sector of Science"]

[Excerpt] The successful resolution of the task posed by the 27th CPSU Congress of shifting the national economy onto the rails of intensification and the acceleration of the socio-economic development of the country depends largely on Uralmash and the innovations and improvements of the equipment that it is creating today.

An integral part of the plant and the production association of Uralmash, its "nerve center," is the Scientific Research Institute and Technological Design Institute of Heavy Machine Building (NIITYAZHMASH).

It was created in 1959, the design, technological and other engineering services existing at the plant were combined in it, and life has confirmed the farsightedness of this step. Not separated from production by any administrative partitions and organically combined with it in a unified whole, NIITYAZHMASH provides for the comprehensive resolution of all design tasks and, very importantly, a considerable reduction in the time periods for the development and production of new equipment. The institute makes it possible to create modern highly productive and economical machinery and equipment at the level of the best world standards or even exceeding them. Uralmash owes its fame largely to the plant's scientists, designers and process engineers.

How close NIITYAZHMASH is to production can be judged by the fact that the plant management and the institute are located, it can be said, in the same building, from which it is a stone's throw to the many shops of the enterprise. Walking along the corridor, you cannot tell at once whether you are in plant administration or in NIITYAZHMASH. The laboratory wing of the institute and its experimental shop, where various research is conducted (the institute includes 62 design-rating and scientific research laboratories) are alongside the plant shops.

The inseparability and contiguity of the plant and the institute is also apparent in the fact that today a specialist works, say, in the institute,

while tomorrow he can be sent to a shop or to plant management and vice versa. By way of example, take Boris Dmitriyevich Kotelnikov. He has worked for many years both at the institute as a design engineer, deputy chief designer and deputy director for scientific research, and at the plant, as deputy chief engineer. In 1975 he was named director of the institute, and today he is chief engineer and first deputy to the general director of the production association. Kotelnikov is a candidate of technical sciences and a USSR State Prize laureate.

The plant sector of science, as we see, is the unification of science and production. The creation of the powerful Uralmash machinery is inconceivable today without the support of science and genuinely scientific work.

The equipment created according to the plans of the scientists and designers of NIItiyazhmash, it can be stated directly, is unique. It includes the ESh-100.100 walking excavator (with a scoop of 100 cubic meters capacity and a boom length of 100 meters), Uralmash-15000 high-powered drilling rigs intended for studying the Earth's core at a depth of up to 15,000 meters, rolling mills and first-class highly productive equipment for blast furnaces, continuous-casting blanks machinery and powerful presses for forging, stamping and press-forming various metals and alloys. The institute has designed over 500 models of machinery and equipment overall.

All of the products of Uralmash are manufactured according to documentation developed by NIItiyazhmash--a large collective of scientists, designers, process engineers and researchers. Many of them have scientific degrees and have been awarded Lenin and State prizes. Among the laureates are G.N. Bashilov, the director of the institute, G.Kh. Boyko, V.A. Bykov, L.A. Bykov, V.P. Vasilkovskiy, B.N. Dralyuk, A.P. Kolomeytsev, V.M. Niskovskikh, P.P. Pleshkov, Ye.V. Redkin, V.V. Rudoiskatel and many others. Their thought, talent and labor, their life, is devoted to creating sensible, improved and highly productive equipment for the industry of the country.

What are the scientific research and planning and design departments of the institute working on today?

Let's get acquainted with one of them--the department for continuous-casting blanks machinery [CCBM]. The efficiency of CCBM is well known. Usually, in the traditional pouring of steel into molds, 600-700 kilograms of metal product are obtained from a ton of steel, but the use of CCBM brings this figure to 900. The continuous-casting blanks machinery has a doubled working speed in pouring steel and produces the highest-quality slabs with the best strength characteristics. CCBM makes it possible to obtain an additional 2 million tons of slabs a year and conserve about 4.5 billion kilowatt-hours of electric power (compared to traditional pouring). Furthermore, the working conditions of the workers are improved immeasurably, and some of them are freed up altogether.

Nonetheless, this machinery still does not exist at many metallurgical plants, even major ones. Moreover, the incorporation of CCBM slowed appreciably at the beginning of the 1980s. Not a single piece of CCBM has been produced by Uralmash in the first three-plus years of the 11th Five-Year Plan. Because



Minchermet [Ministry of Ferrous Metallurgy] first planned to install it at a number of plants, and then reconsidered. Now, when the reconstruction of enterprises is ubiquitous, the need for CCBM has increased sharply. An intensive program for the incorporation of this equipment in ferrous metallurgy has been developed for the 12th Five-Year Plan--at the Magnitogorsk [Magnitka], Chelyabinsk and Cherepovets metallurgical combines and the Plant imeni Ilich in Zhdanov.

At Magnitka--the contemporary and past companion-in-arms of Uralmash--a high-capacity oxygen-converter plant is being erected, the first phase of which should enter service in 1989, in place of the open-hearth shops there now. Uralmash will design and manufacture four unique types of CCBM for this plant.

A diagram for curvilinear CCBM--the offspring of the designers of a department of the institute--hangs on the wall in the office of the chief CCBM designer, Doctor of Technical Sciences V.M. Niskovskikh. The chief designer related the history of the creation and refinement of this machinery and, of course, how the work was progressing in planning it for Magnitka. Also taking part in the discussion was P.M. Sloveychik--the chief plan designer for this plant.

The CCBM for Magnitka will be more productive, economical and refined in control than what was produced earlier. The metal-intensiveness of the new machinery is being reduced by 20 percent. For the first time in world practice, steel will be poured in both two and in four strands, depending on the thickness of the slabs needed--large or small. The new equipment for the metallurgical production of Magnitka will make it possible to obtain higher-quality blanks and almost 200,000 tons more rolled metal than is now obtained from every million tons of molten metal.

"The Magnitka work is ahead of schedule," related Niskovskikh. "The development of the detail design is done, finished in half a year, while earlier the planning of less complex machinery usually took 9 months. It can be said that we are working fast. Our specialists are now working on the contractor design. It will also be completed ahead of the planned time period. Part of the drawings have been released to production already."

This lively creative work on improving equipment output is typical of other departments of the institute as well. The oil-recovery workers of the country are making greater and greater demands of the drilling rigs, and the designers in the rig department are trying to improve them. They have worked a great deal in particular on improving the Uralmash-3000 EUK drilling rig (lead designer is P.P. Pleshkov) intended for the cluster drilling of inclined wells in marshy terrain. [rest of article unavailable]

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AUTOMATION OF PRODUCTION, INCREASE IN PRODUCTIVITY OF LABOR

Moscow MASHINOSTROITEL in Russian No 11, Oct. 80 pp 36-37

[Article by V. Ya. Gumenyuk, candidate of economic sciences]

[Text] A better technical standard of equipment is one of the reserves for increasing the productivity of labor. Thus, automatic equipment raises the productivity of the machines themselves, as well as increasing the number of machines that can be serviced simultaneously by an operator or brigade.

This factor was taken into account as a basis for developing "Methodological instruction in evaluating the degree and level of automation of production...", approved by the USSR GKNT [State Committee of the USSR Council of Ministers on Science and Engineering] in 1985.

The labor tools used (machines and manual work positions) are classified by the number of machine links  $z$  or by the number of basic work functions of the laborer (see Table). Thus, nonautomated machine tools and presses are classified as three-linked ones (machine-tool, machine-engine and transmission mechanism). Automatic machine tools ( $z=4$ ) contain still another link -- a monitoring-controlling device, therefore, still another of the worker's function-monitoring and controlling the machine tool -- is replaced. In semi-automatic machines this link replaces the monitoring and control function partially by about half, therefore, for them  $z=3.5$ . Modern technological control systems of a totality of machines -- a superlink of its kind which can replace, to a different degree, human functions in coordinating the work and readjustment of the machine totality. Moreover, in determining the number of machine links, additional mechanization and automation devices installed on the machines or at the machines (machine tool fixtures for securing intermediate products, lifting devices etc.), must be taken into account. When such devices are used the number of machine links increases by  $\Delta z=0.25$ . The number of machines is determined by the number of positions (machines-tools) in automatic robot-technological lines, multipositional automatic machines and semiautomatic machines in flexible automated sections (GAU) etc.

As seen in the Table, the productivity of labor of the operator and adjuster, when using automatic lines and cybernetic technology increases on the average of 5 to 8-fold as compared to nonautomatic machines. In this case, labor productivity can double due to the expansion of the servicing zone by the

operators and adjusters. However, in practice it does not increase to such an extent. The situation is that in calculating the relative increase in the productivity of labor, norm values and the best experience of multimachine tool equipment servicing by operators and adjusters were used. Actually, however, the number of semiautomatic and automatic machines, and NC machine tools, serviced by operators, is considerably smaller than the established norm. The number of operators and adjusters who service automatic lines is also usually greater than specified by the consolidated norms or design calculations. For example, according to the technological design norms of machine shops, one machine tool operator must service 3 to 4 gear-planing machine tools, 4 to 5 gear-cutting or 2 to 3 NC gear-shaping machine tools. At the same time a number of machine tool building plants almost lack multimachine tool servicing at gear-cutter machine tool sections and there are fairly numerous cases where an operator services only one NC machine tool.

There are several objective and subjective reasons for the comparatively low level of multimachine tool operation. The objective causes include the general trend in reducing the dimensions of parts and, correspondingly, machining cycles which reduces the possibilities of multimachine servicing (for example, in instrument building enterprises). It is not always possible to locate machine tools to produce conditions for multimachine tool servicing. There are also causes that can easily be eliminated. Thus, it would be necessary to review the existing regulation of the wages of multitool machine operators, according to which wages increase only when the servicing norm is exceeded. Thus, if, for any reason, an operator cannot service, let us say, four machine tools according to the norm, he is not materially interested either in servicing 2 to 3 machine tools.

The expansion of the servicing zone, as may be seen in the Table, is the most important factor in the productivity of labor under conditions of accelerated automation. However, its importance is underestimated in the propaganda for advanced experience of enterprises and better multimachine tool operators. Obviously, in material and moral incentives for a broad movement in machine building (according to the example of textile workers), the necessity of the expansion of the servicing zone for servicing machine tools and units grew. The capital investments are not required to utilize this reserve. At the same time, it is possible to repay, for expensive automatic equipment in principle, by the considerably greater productivity of labor due to multimachine tool servicing.

The second basic component of a high productivity of labor is an increase in the productivity of the machine tools themselves. There are great reserves in this area. Cybernetic equipment and machines, incorporated in automatic lines, are several times more productive than the more widely distributed so far nonautomatic machine tools and units. However, the changeover to the wide use of new in principle equipment involves additional capital investments and requires a certain amount of time. Therefore, by not expecting the implementation of the program for the wide introduction of cybernetic equipment, we can right now increase the productivity of labor considerably by equipping the available equipment with additional mechanization and automation devices (machine tool fixtures, bunker loading devices, materials handling mechanisms etc.). In this case, as shown by investigations, labor productivity



Table

Kinds of machines and manual tools	Links z	Increasing servicing zone	Productivity machines operator-adjuster	Examples of work and technical facilities
Manual tools (work positions for manual labor)	0	-	0.25	Work with manual tool or without it, manual loading, work surfaces with scraper or file
Simplest devices	1	1	0.4	Mechanical cart, mechanical impact wrenches, hand-operated press
Mechanized tool and equivalent devices	2	1	0.6	Electrical and pneumatic drills, pneumatic impact wrench, manual arc welding device, electrical solderer
Nonautomatic machines	3	1	1	Universal machine tools, presses, hammers etc.
Semiautomatic machines and equivalent installations	3.5	1.1	1.6	Semiautomatic machines in the generally adopted sense, electroplating and electro-erosion installations with manual loading of parts
Automatic machines	4	1.6	2.7	Automatic machines in the generally adopted sense
NC automatic machines	4.25	1.8	3.1	Same
Machines in automatic lines and equivalent robot equipment sets (RTK)	4.5	2.4	2.7	Automatic lines, as well as "robot-technological machine" type sets



Table (continued)

Kinds of machines and manual tools	Links z	Increase in service zone	Productivity Machines	operator- adjuster	Example of work and technical facilities
Machines in robot equipment and other flexible automatic lines	4.75	1.5	4.1	7.2	RTK and flexible production modules connected by a common transportation and control sys- tem
Machines in flexible auto- matic sections of shops and plants	5.0	1.75	4.5	7.8	According to GOST 26228-84. Production indicators were determined approximately.

increases by about 20 percent; the installation of bunkers makes possible multimachine tool servicing and, correspondingly, more than doubles the productivity of labor.

As a whole the productivity of labor depends on the number of machine links that "arm" the worker. This is, in its way, an indicator of the "technical arming of labor." For example, when operating a nonautomatic machine tool  $z_{\text{nc}}=3$ ; when two automatic machines serviced by a machine tool operator  $z_{\text{a}}=8$ ; for servicing two NC machine tools  $z_{\text{nc}}=4.25 \times 2=8.5$ ; for servicing, let us say, a six-position automatic line  $z_{\text{a}}=4.5 \times 6=27$ .

The productivity of labor of the worker increases correspondingly as compared to work on a nonautomatic machine tool (see Table).

Thus, the goal of the work of enterprises must become an increase in  $z$ , an important criterion of socialist competition between brigades, sections and shops, and an appraisal of the organizational-engineering level of work positions and sections.

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